Two Way Analysis of Variance - Two Factor Mixed Design
(2 Independent Variables with repeated measure on One Factor)

For this problem, a researcher was interested in finding out if group discussion would influence a participant's willingness to engage in greater risk taking. The researcher felt that people would be more likely to make a risky decision after discussion than prior to discussion. The researcher was also interested in whether the discussion process would influence the decisions of men differently than the decisions of women. What the researcher did was to take a group of male and female participants and had them read a story that involved their being put in the position of an advisor to a businessman who was considering a job change to a newly forming company. The participant was to read the story and decide what the new company's <u>minimal</u> odds of success would have to be before recommending the businessman make a job change to that company. Notice that the lower the minimal odds of success before recommending the change, the greater risk the participant is taking. The participant circled one of the numbers from a scale like that below:

The minimal odds of success of the new company would have to be:

chances out of 10: 1 2 3 4 5 6 7 8 9 10: chances out of 10

before I recommended a job change for the businessman.

After giving their individual recommendations, each participant discussed their opinion about the story with a group of other people. Then after the discussion process, they were again asked a second time to complete the risk scale above. The purpose of this was to determine whether the discussion process facilitated the participant recommending a more conservative or more risky decision. The responses for the male and female participants, both prior to and after discussion are listed below.

		(Column 1) Prior to Discussion	(Column 2) After Discussion
Males (Row 1)	S1	7	5
	S2	8	6
	S3	7	6
	S4	6	4
	S5	5	3
Females (Row 2)	S6	5	3
	S7	6	4
	S8	7	6
	S9	9	7
	S10	7	5

1. Logon to system
2. **Click Start > Programs > SPSS for Windows > SPSS 10.1 for Windows**. At this point a window will appear asking you what you would like to do. Click on the circle next to Type in Data (2nd option in list) and then click **OK** at the bottom of the window.
3. A Data Editor will appear. Look in the lower left corner of the screen. You should see a **Data View** tab and to the right of it a **Variable View** tab. The **Variable View** tab will be used first for the Data **Definition** Phase of creating a data file. The Data **View** tab will be used to actually enter the raw numbers listed above. (See pages 1-3 for a more detailed explanation of creating data files.)

DATA DEFINITION PHASE

4. Click on the **Variable View** tab in the lower left corner. A new screen will appear with the following words at the top of each column.
   Name Type Width Decimals **Label Values** Missing Columns Align Measure

5. Click on the white cell in **Row 1** under the word **Name** and type in the word **Gender**
6. Click on the white cell in **Row 1** under the word **Label** and type in **Subject Gender**. (Doing this will provide you with a more expansive label in the results output).
7. Click on the white cell in **Row 1** under the word **Values**. The word none will appear along with a small grey box to the right.
   a. Click on the small grey box and a Value Labels window will appear
   b. In the white box next to the word **Value**, type in the number **1**
   c. Click on the white box next to the word **Value Label** and type in **Males** then
   d. Click on **Add** button: 1 = "Males" will appear in bottom white box
   e. Click on the white box next to the word **Value** and type in the number **2** then
   f. Click on the white box next to the word **Value Label** and type in **Females** then
   g. Click on **Add** button: 2 = "Females" will appear in bottom white box also
   h. Click **OK**
8. Click on the white cell in **Row 2** under the word **Name** and type in the word **Prior** then
9. Click on the white cell in **Row 2** under the word **Label** and type in **Pre Discussion** (Doing this will provide you with a more expansive label in the results output).
10. Click on the white cell in **Row 3** under the word **Name** and type in the word **Post** then
11. Click on the white cell in **Row 3** under the word **Label** and type in the **Post Discussion** (Doing this will provide you with a more expansive label in the results output).

DATA ENTRY PHASE

12. Click on the **Data View** tab in the lower left corner. The data **view** screen will now appear with Column 1 named **Gender** (for subject gender), Column 2 named **Prior** (for the pre-discussion responses), and Column 3 named **Post** (for the Post-discussion responses).
13. Enter the data for each of the 10 participants as follows. Click on the top left cell under the first column **Gender** and enter:

1 tab 7 tab 5
1 tab 8 tab 6
1 tab 7 tab 6
1 tab 6 tab 4
1 tab 5 tab 3
2 tab 5 tab 3
2 tab 6 tab 4
2 tab 7 tab 6

The numbers on each line (e.g. 1, 7, 5) represent in order the code for gender where a 1 = males and a 2 = females, the pre-discussion response and the post-discussion response.

2 tab 9 tab 7
2 tab 7 tab 5

Data Analysis

1.   Click **Analyze** at top of screen then
        i.   Click on **General Linear Model** then
        j.   Click on **GLM-Repeated Measures** (When you do this a Define Factor(s) box will appear)
2.   In the **within subject factor** name space, double click on **Factor 1** and type in **Discuss** then
        a.   Click on the Number of **Levels** space and enter a **2** (since there are two levels of discussion - pre & post discussion.
        b.   Click on the **Add** button
3.   Click on **Define** button
4.   Highlight the word **Pre-Discussion [prior]** by clicking on it, then
        a.   Click on **arrow >** to transfer this name to the **within** subjects variable Box at __?__[1]
5.   Highlight the word **Post Discussion [post]** by clicking on it, then
        a.   Click on **arrow >** to transfer this name to the **within** subjects variable Box at __?__[2]
6.   Highlight the word **Subject Gender [gender]** by clicking on it, then
        a.   Click on **arrow >** to transfer this name to the **Between** subjects **Factor** Box
7.   Click on **Options** button
8.   Highlight (**Overall**) by clicking on it then
        a.   Click on **arrow >** to transfer this name to the **Display Means** for Box
9.   Highlight **Gender** by clicking on it then
        a.   Click on **arrow >** to transfer this name to the **Display Means** for Box
10.   Highlight **Discuss** by clicking on it then
        a.   Click on **arrow >** to transfer this name to the **Display Means** for Box
11.   Highlight **Gender*Discuss** by clicking on it then
        a.   Click on **arrow >** to transfer this name to the **Display Means** for Box
12.   Click on white square in front of **descriptives statistics** box to place a check mark in it (appears under the heading "display"
13.   Click on **Continue** button
14.   Click **OK** Doing this will result in the analysis being conducted. These results are below.

Descriptive Statistics

	Subject Gender	Mean	Std. Deviation	N
Pre Discussion	Males	6.6000	1.14018	5
	females	6.8000	1.48324	5
	Total	6.7000	1.25167	10
Post Discussion	Males	4.8000	1.30384	5
	females	5.0000	1.58114	5
	Total	4.9000	1.37032	10

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
DISCUSS	Pillai's Trace	.953	162.000[a]	1.000	8.000	.000
	Wilks' Lambda	.047	162.000[a]	1.000	8.000	.000
	Hotelling's Trace	20.250	162.000[a]	1.000	8.000	.000
	Roy's Largest Root	20.250	162.000[a]	1.000	8.000	.000
DISCUSS * GENDER	Pillai's Trace	.000	.000[a]	1.000	8.000	1.000
	Wilks' Lambda	1.000	.000[a]	1.000	8.000	1.000
	Hotelling's Trace	.000	.000[a]	1.000	8.000	1.000
	Roy's Largest Root	.000	.000[a]	1.000	8.000	1.000

a. Exact statistic

b.
Design: Intercept+GENDER
Within Subjects Design: DISCUSS

Mauchly's Test of Sphericity[b]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
						Epsilon[a]	
DISCUSS	1.000	.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in t Tests of Within-Subjects Effects table.

b.
Design: Intercept+GENDER
Within Subjects Design: DISCUSS

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
DISCUSS	Sphericity Assumed	16.200	1	16.200	162.000	.000
	Greenhouse-Geisser	16.200	1.000	16.200	162.000	.000
	Huynh-Feldt	16.200	1.000	16.200	162.000	.000
	Lower-bound	16.200	1.000	16.200	162.000	.000
DISCUSS * GENDER	Sphericity Assumed	.000	1	.000	.000	1.000
	Greenhouse-Geisser	.000	1.000	.000	.000	1.000
	Huynh-Feldt	.000	1.000	.000	.000	1.000
	Lower-bound	.000	1.000	.000	.000	1.000
Error(DISCUSS)	Sphericity Assumed	.800	8	.100		
	Greenhouse-Geisser	.800	8.000	.100		
	Huynh-Feldt	.800	8.000	.100		
	Lower-bound	.800	8.000	.100		

4. Subject Gender * DISCUSS

Measure: MEASURE_1

Subject Gender	DISCUSS	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Males	1	6.600	.592	5.236	7.964
	2	4.800	.648	3.306	6.294
females	1	6.800	.592	5.436	8.164
	2	5.000	.648	3.506	6.494

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	672.800	1	672.800	179.413	.000
GENDER	.200	1	.200	.053	.823
Error	30.000	8	3.750		

1. Grand Mean

Measure: MEASURE_1

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
5.800	.433	4.801	6.799

2. Subject Gender

Measure: MEASURE_1

Subject Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Males	5.700	.612	4.288	7.112
females	5.900	.612	4.488	7.312

3. DISCUSS

Measure: MEASURE_1

DISCUSS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	6.700	.418	5.735	7.665
2	4.900	.458	3.843	5.957

15.   For the problem above the null and alternative hypotheses are spelled out below:

H_{null}:   a)   The means of the two gender conditions will be equal. (There will be no main effect for gender).

b)   The means of the pre and post group discussion responses will be equal. (There will be no main effect for discussion).

c)   The pattern of the pre to post discussion responses for females will be identical to the pattern of pre to post discussion responses for males.

H_{alt}:   a)   The means of the two gender conditions will not be equal. (There will be a main effect for gender).

b)   There will be a main effect for discussion with the post discussion responses reflecting a greater amount of risk taking than the pre discussion responses.

c)   The pattern of the pre to post discussion responses for females will not be identical to the pattern of pre- to post discussion responses for males.

16.   **Interpretation and APA writing template for Results Above**

A 2 x 2 two way mixed analysis of variance was conducted to determine whether discussion and participant gender influenced the level of risk a participant was willing to take. Results of that analysis indicated no main effect for participant gender, $F(1, 8) = .05$, $p > .05$. The mean levels of risk taking for males and females were, respectively, 5.7, and 5.9. Results did indicate a main effect for discussion, $F(1, 8) = 162.00$, $p < .05$ with the post discussion responses reflecting significantly greater risk taking ($M = 4.9$) than the pre discussion responses ($M = 6.7$). The interaction between participant gender and discussion was not significant, $F(1,8) = 0.00$, $p > .05$.